Supporting Information

An enhanced photoelectrochemical platform: Graphite-like carbon nitride nanosheets functionalized ZnO nanotubes

Yan Zhang,^a Mei Yan,^a Shenguang Ge,^{a,b} Chao Ma,^a Jinghua Yu,*,^a Xianrang Song^c

^a School of Chemistry and Chemical Engineering, University of Jinan, Jinan 250022,

P.R. China *Email - ujn.yujh@gmail.com

^b Shandong Provincial Key Laboratory of Preparation and Measurement of Building Materials, University of Jinan, Jinan 250022, P.R. China

^c Shandong Provincial Key Laboratory of Radiation Oncology, Shandong Cancer Hospital and Institute, Jinan 250117, P.R. China

1. Instrumentation

Electrochemical impedance spectroscopy (EIS) was carried out on an IM6x electrochemical station (Zahner, Germany). Impedance measurements were performed by applying an AC voltage of 5 mV amplitude in the frequency range of 0.01 Hz to 10^5 Hz in a 5 mM [Fe(CN)₆]³⁻ ^{/4-} redox probe solution with 0.1 M KCl. Photoluminescence (PL) spectrum were recorded on a RF-5310pc spectrofluorophotometer (Shimadzu, Japan). UV-vis spectra were obtained on a Shimadzu UV-2550 UV/vis spectrophotometer (Shimadzu corporation, Japan). Infrared spectroscopy (IR) was achieved on a Fourier transform infrared (FT-IR) Spectrum RX (PerkinElmer Spectoment). Scanning electron microscopy (SEM) images were obtained using a QUANTA FEG 250 thermal field emission scanning electron microscopy (FEI Co., USA). Transmission electron microscopy (TEM) images were obtained from a JEOL JEM-1400 microscope (Japan). The phase characterization was performed by X-ray diffraction (XRD) using a D8 advance diffractometer system equipped with Cu Ka radiation (Bruker Co., Germany). PEC measurements were performed with a homemade PEC system. A 500 W Xe lamp (CHF-XM500) equipped with monochromator (CHF-300) (Beijing Changtuo.) was used as their radiation source. Photocurrent were measured on a CHI 760D electrochemical workstation (Shanghai Chenhua).

2. Preparation of ZnO nanotubes array

Before preparing ZnO nanotubes, ZnO nanorods were prepared by a simple and low-cost hydrothermal process.^{1,2} Prior to experiment, copper strips were cleaned with acetone and ultrapure water in an ultrasonic cleaner, then used as the substrate. In typical experiments, zinc acetate dehydrate (40 mM) dissolved in ethanol (10 mL) at 90 °C was prepared as a high density seed solution. The seed solution was spin-coated on the substrate. The copper strip covered with a ZnO seed layer, was dried at 90 °C to remove excess moisture and other residuals. The coating and heating cycle was repeated five times. The modified copper strip was then vertically immersed into the reaction solution. The nutrient solution used here was composed of a 25 mM 1 : 1 ratio of zinc nitrate and hexamethylenetetramine. The reaction was carried out at 95 °C for 5.5 h in a conventional laboratory oven, and then the Teflon reaction kettle was cooled down naturally for 1.5 h before that it was taken out. Subsequently, the fabricated copper-based ZnO nanorods were washed repeatedly with ultrapure water and baked at 70°C in a laboratory oven. To prepare ZnO nanotubes array, the resulted ZnO nanorods were placed in an alkaline solution of 0.25 M NaOH at 85 °C for 120 min. Then ZnO nanotubes arrays were obtained after washing with five times.



Fig. S1 XRD patterns of bare ZnO nanorods (a) and g-C₃N₄ nanosheets modified ZnO nanotubes (b).





Fig. S3 (A) SEM image of silica, (B) TEM image of gold nanoparticles.

References

- 1. A. Manekkathodi, M.-Y. Lu, C. W. Wang, L.-J. Chen, Advanced Materials, 2010, 22, 4059-4063.
- 2. A. Wei, X. W. Sun, C. X. Xu, Z. L. Dong, Y. Yang, S. T. Tan, W. Huang, *Nanotechnology*, 2006, 17, 1740.